

CLAIMS

What is claimed is:

- Sub A1
- 1) A software control method of modeling a swept volume for a computer simulated object comprising:  
generating a polyhedral representation of a computer modeled object;  
representing motion of the object with a set of position matrices;  
determining a subset of free neighborhood entities comprising the object for each matrix;  
generating traces by the motion of the free neighborhood entities; and  
constructing a representation of the swept volume from the traces.
  - 2) The software control method of claim 1 wherein the free neighborhood entity is an edge.
  - 3) The software control method of claim 1 wherein the free neighborhood entity is a triangle.
  - 4) The software control method of claim 1 wherein a free neighborhood is represented by an angular portion for different types of entities comprising the boundary of the polygon.
  - 5) The software control method of claim 4 wherein a free neighborhood comprises a material zone represented by a half sphere containing material of object and delimited by a plane of a triangle.
  - 6) The software control method of claim 4 wherein the free neighborhood comprises a tangent zone represented by two portions of a sphere, wherein the two portions of the sphere are delimited by planes of adjacent triangles.
  - 7) The software control method of claim 1 wherein the polyhedral representation comprises two triangles representing translational motion of an edge.
  - 8) The software control method of claim 1 wherein the polyhedral representation comprises four triangles representing translational and rotational motion of an edge.
  - 9) The software control method of claim 1 wherein the motion between two consecutive matrices is assumed to be linear.
- Sub A2

- A2
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- 10) The software control method of claim 1 wherein an entity comprising an object and moving inside the material path of the object are filtered.
  - 11) A computer system for controlling generation of a swept volume model the system comprising:
    - a processor operatively interconnected to a memory;
    - a user input device;
    - a display; and
    - a graphical user interface responsive to activation with the user input device by causing the a program stored in the memory to be executed by the processor wherein a polyhedral representation of a computer modeled object is generated; motion of the object is represented with a set of position matrices; a subset of free neighborhood entities comprising the object is determined for each matrix; traces are generated by the motion of the free neighborhood entities; and a representation of the swept volume is constructed from the traces.
  - 12) The computer system of claim 11 wherein the position matrices representing motion of the free neighborhood entities are created referencing a database comprising data collected during physical experiments.
  - 13) The computer system of claim 11 wherein the position matrices representing motion of the free neighborhood entities are calculated in response to selection of a motion type from a user interactive menu.
  - 14) The computer system of claim 11 wherein a free neighborhood entity comprising an edge is determined by testing for movement of the edge through a tangent zone.
  - 15) The computer system of claim 11 wherein a free neighborhood entity comprising a triangle is determined by testing for movement through a material zone.
  - 16) A computer program residing on a computer-readable medium, the program comprising instructions for causing the computer to:
    - select an object;
    - extract an array of free neighborhood of triangles and edges from the object based on a trajectory;

select a position matrix;  
transform an array of triangles and edges according to the position matrix;  
compute a trace for an edge comprising the array and moving through a tangent zone and adding the edge to a table or adding a triangle moving through a material zone to the table; and  
modeling a polyhedron from data stored in the table.

- Sub 13
- 17) A computer program residing on a computer-readable medium, the program comprising instructions for causing the computer to:  
generate a polyhedral representation of a computer modeled object;  
represent motion of the object with a set of position matrices;  
determine a subset of free neighborhood entities comprising the object for each matrix;  
generate traces by the motion of the free neighborhood entities; and  
construct a representation of the swept volume from the traces.
- 18) The computer program residing on a computer-readable medium of claim 19 wherein an entity comprising an object and moving inside the material path of the object are filtered.
- 19) A method for interacting with a computer so as to model a swept volume comprising the steps of:  
launching a program that includes a command to generate a swept volume model;  
selecting an object to model;  
selecting a motion to be applied to the object; and  
issuing a command to generate a polyhedron representing a swept volume.
- 20) The method of interacting with a computer of claim 19 wherein the motion selected is translational motion.

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